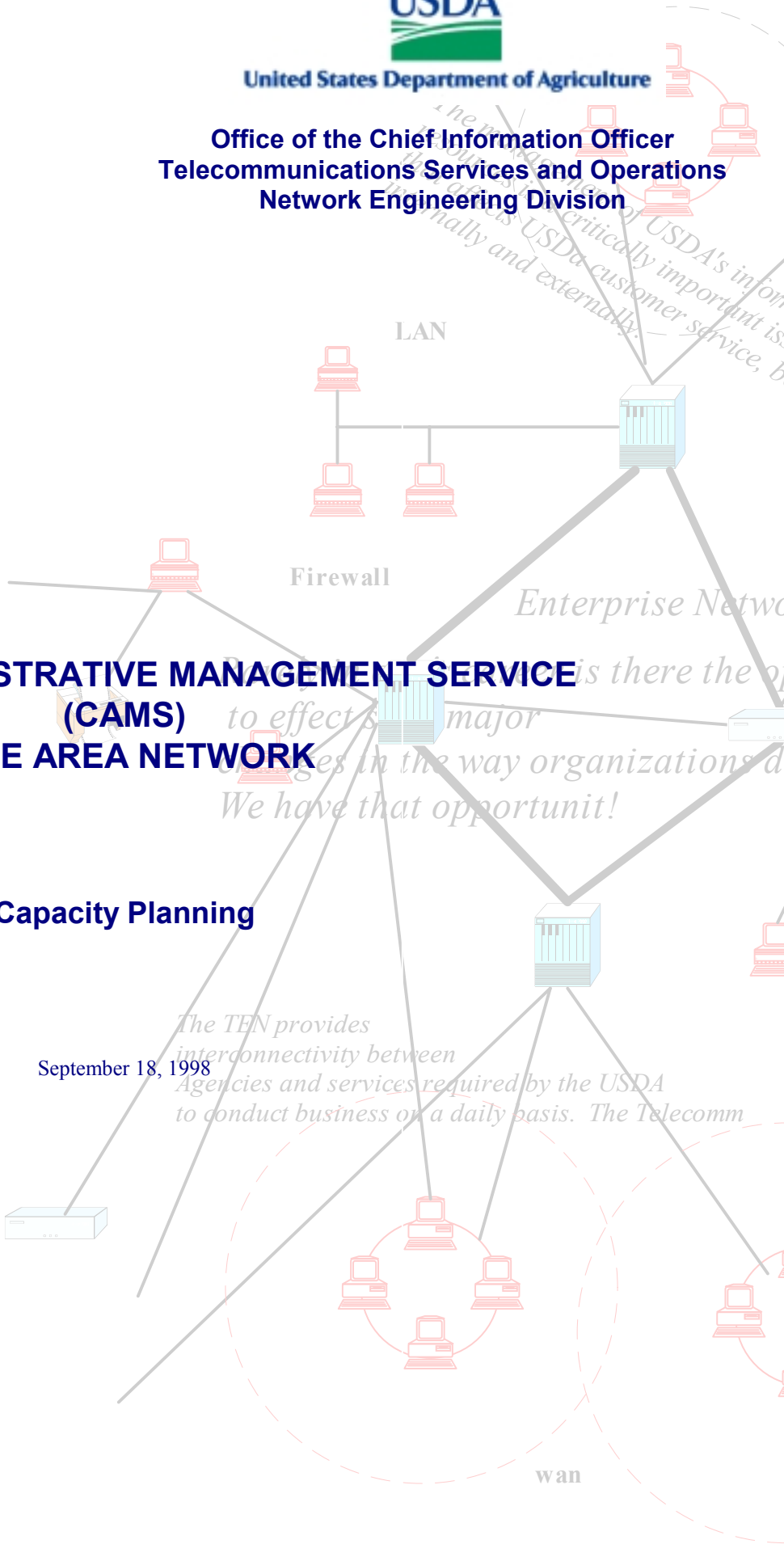
United States Department of Agriculture

Office of the Chief Information Officer
Telecommunications Services and Operations
Network Engineering Division

COMBINED ADMINISTRATIVE MANAGEMENT SERVICE (CAMS) WIDE AREA NETWORK

Capacity Planning

September 18, 1998



1.0 Introduction

The mission programs of USDA Agencies are aimed at meeting the diverse, complex set of services required by American and international private, business, educational, and government communities. To satisfy increasing demands, USDA relies heavily on the latest information technologies. To facilitate the cost-effective use of these technologies, the OCIO is working to develop and implement a Telecommunications Enterprise Network (TEN).[1] Critical to the successful implementation and management of the USDA TEN is the development of a structured methodology for measuring, analyzing, and optimizing information transfer. This document describes the initial development and testing of such a process, Resource Planning Methodology (RPM).

A Resource Planning Methodology is a structured approach to objectively and reliably managing a dynamic information technology infrastructure. RPM requires understanding of the existing network performance and survivability, an understanding of new application features, and an ability to predict the effects on the existing network upon implementation of the new application.

The Network Engineering Division (NED) and the project team for the Combined Administrative Management System (CAMS) have collaborated to define and test a USDA RPM. The test environment is the implementation of a PeopleSoft application to serve multi-agency business requirements. Specifically, the CAMS project helps the NRCS, FSA, and RD agencies of the USDA meet their mission program goals. RPM tools include NetMaker XA for TEN monitoring, evaluation, and design and the Network Associates Sniffer Network Analyzer (Sniffer) for collecting application specific network activity necessary for predicting the effect of implementing new applications.

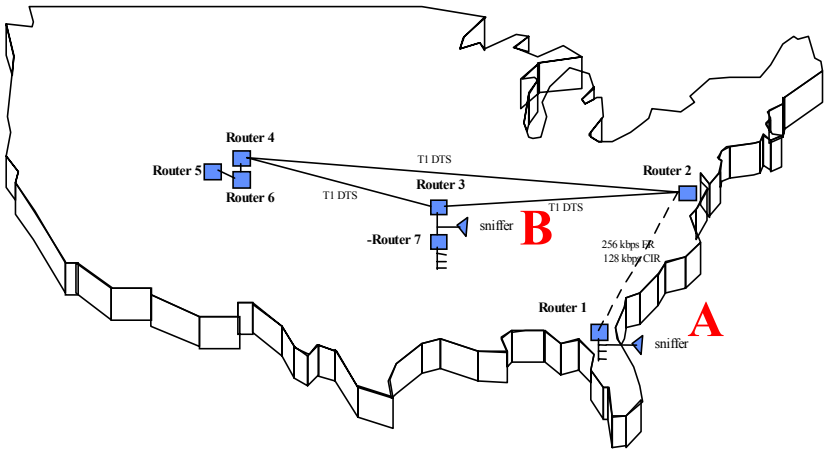
This document represents the effect analysis of the implementation of CAMS on the Florida Network. The CAMS implementation on the Florida Network represents a pilot study designed to test the USDA RPM and suggest refinements. In the future, the RPM will be tested on a larger five-state network. From the larger pilot test, documents will be generated describing the RPM projected effect compared to empirical data on the effect of CAMS on the network.

[1] The details of the development of the USDA TEN are documented in a series of design reports produced by the Network Engineering Division.

2.0 Methodology

A CAMS Florida Network model (Figure 1) was created from physical and traffic information discovered with the NetMaker XA®[2] network analysis system. The NetMaker XA Simple Network Management Protocol agent dynamically polls routers to obtain information stored inside each router's Management Information Base. The information includes router configuration, connectivity, and traffic. For a defined period, the polling procedure collects router statistics on the amount of traffic at device serial interfaces. The "discovery" is used to map a particular network. For the CAMS Florida Network model, network baseline traffic was measured before; during and after the August 18, 1998 CAMS test. This network discovery procedure using NetMaker XA usage-based traffic that does not identify specific applications. Specific network application analysis is derived from data collected with Sniffers placed on the wide area network (WAN) side of router 7 (National Information and Technology Center, Kansas City, MO) and on the local area network (LAN) side of the router 1 located in Gainesville, FL (See Figure 1, A and B respectively).

Network traffic is the data transferred between two WAN nodes, independent of the type of technology used. Based on defined timing procedures and internet protocol (IP) addressing, specific applications can be identified within the general network traffic. Using the CAMS Florida Network model as configured in Figure 1, baseline traffic data was captured at five- minute intervals in an attempt to see "peaks" of activity on each circuit. The Sniffer in Kansas City was set at a capture interval of 30 minutes to correlate with the baseline traffic. The Sniffer in Gainesville used a one-minute capture interval to allow identification of transactions (logon, viewing one panel etc.) during the testing period.



[2] NetMaker XA is a registered trademark of Make Systems, Inc.

3.0 Analysis

Traffic data collected on the CAMS Florida Network was analyzed with the NetMaker XA Analyzer module. Using interval analysis to simulate traffic demands for specific time intervals, the Gainesville, FL to Washington, D.C. 128kbps Frame Relay (FR) CIR link was used to simulate traffic demands for particular transactions (dashed line on Figure 1). Appendix B presents utilization reports for several simulations of different CAMS test transactions. **(Appendices not available online. Contact NED for more information)**

Microsoft Excel was used to perform parallel processing of the data (Fig 2). Appendix A presents demands measured by the Sniffer located in Kansas City, MO compared to the baseline traffic captured for the circuit.

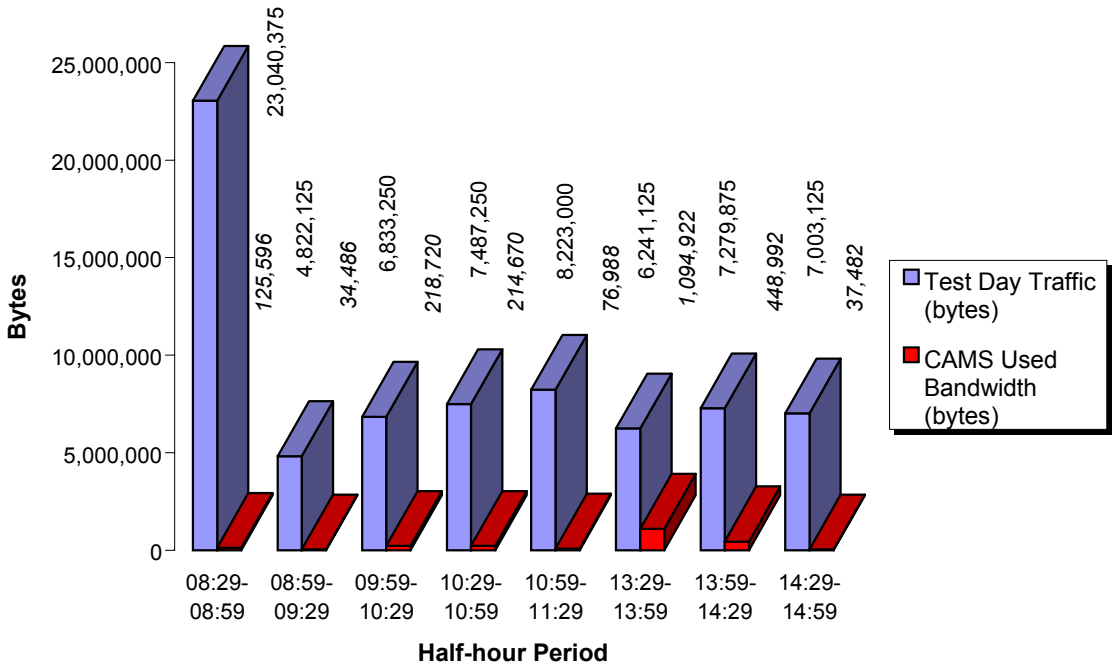


Figure 1 Bytes of Traffic for Gainesville, FL to Washington, D.C. Circuit

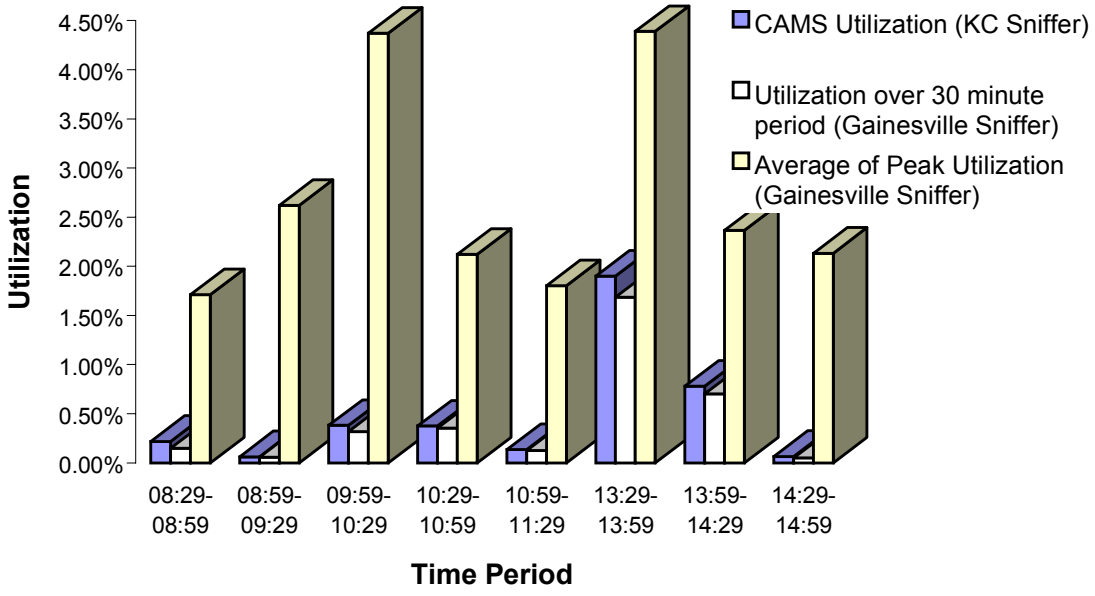


Figure 2 Comparison of NA Analyzer Utilizations for Gainesville Test

CAMS utilization compared to average and peak utilization calculations of network traffic is presented in Figure 3. Calculations are based on specific daily periods. The traffic demands captured on the Kansas City Sniffer were slightly higher than the Gainesville captured demands. This result indicates that the Kansas City Sniffer captured the "network overhead" associated with each demand. CAMS utilization (KC Sniffer) and utilization (Gainesville Sniffer) are represented by the first two bars in Fig. 3 and reflect the results of 30-minute capture intervals. NetMaker and Excel average the bit rate over the 30-minute capture period. Although this is called a sustained demand, it may give a false impression of utilization because CAMS is a transaction based application and several transactions—generating significant amounts of traffic—occur during a 30-minute time period. In compensation for this effect, an average peak statistic was calculated (third bar in Figure 3).

4.0 Findings

- Data collected on the CAMS Florida Network suggests that, on average, CAMS implementation will have a minimum impact on circuits that are sufficiently sized for existing traffic.
- Peak transactions must be recognized and modeled to include potential performance problems. During the test, no performance degradation was experienced probably due to test transactions and the number of users.

- Undersized circuits that are already heavily used could experience serious degradation during peak traffic periods.
- Although not part of the WAN circuit analysis, NED noted the traffic between local clients and the NT server in Gainesville, FL. Data in Appendix B show that each login consists of a large data transfer between the user and the local NT server. That data transfer averaged 7.2 Mbytes per user for the five-person logon activity and about 5.2 Mbytes per user for the three-person logon activity. This transfer **will** cause congestion on the LAN and, it should be recognized, that any delays encountered during this process are not attributable to the WAN. The traffic to the application/database server (Kansas City, MO) followed each large data transfer and was around 20kbytes per user.

5.0 Recommendations

Two sets of CAMS demand profiles must be developed to address the economic and performance impact of CAMS. One set reflects the average sustained demand and the other reflects the peak demands. The different utilization and performance metrics can be compared and the decision made to meet the basic criteria.

When demand parameters are approved by the CAMS and NED teams, bandwidth utilization will be extrapolated and simulated for:

- the next four states (Indiana, Pennsylvania, Arkansas, and Oregon) using the current network,
- all Farm Service Administrative Management Centers,
- the proposed enterprise network.

The predicted utilization and performance will be compared to the actual four-state implementation and subsequently used to produce refined CAMS profiles. As CAMS is implemented for USDA Service Center sites, RPM predictions will again be compared with empirical results.

To better evaluate CAMS impact, improved capturing methods must be employed. Sniffer data is the best source and must be calibrated to each CAMS transaction. Calibration requires having each Sniffer capture intervals with each CAMS transaction. The Sniffer capture intervals should not overlap CAMS transactions.

Since the server node affects all users of CAMS, a Survivability Index will be determined. For Gainesville, if router 1 fails, users will not be able to use the FR circuit. More analysis is required to determine if other nodes dramatically affect network survivability.